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SOY BEANS IN SYSTEMS OF FARMING IN THE COTTON BELT

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THE SOY BEAN is destined to take a very important place in the agriculture of the cotton belt, not only as a means of improving the soil but also as a feed and commercial crop. It has already been grown with marked success in many parts of the South, and in one section of northeastern North Carolina has become a staple crop. This bulletin presents a brief description of the ways in which successful growers handle this crop in the Southern States.

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COMMERCIAL PRODUCTION PROMISING.

IT IS THE PURPOSE of this bulletin to show how soy beans may be used in systems of farming in the cotton belt. The directions given are based on an economic study of soy beans in northeastern North Carolina, on widespread observations of soy beans growing under farm conditions in the South, and on miscellaneous data obtained from various other sources throughout the cotton belt. Except in northeastern North Carolina, where there is located the most important soy bean district in the country, and on a few scattered farms elsewhere, soy beans have not become a commercial product in the cotton belt; but economic conditions have changed, and in many areas of the South this crop may now be introduced with profit.

USES OF SOY BEANS.

The primary use of soy beans, as now handled in the South, is to improve the soil. It is a legume, and through the bacteria that form nodules on the roots of the plant it has power to use the free nitrogen in the air. Farmers say that ordinarily as a result of planting soy beans one year the yields of the succeeding crops are increased from 10 to 15 per cent, and where soy beans are planted in rotation for several years the yields of other crops are frequently increased by 50 per cent, apparently as a result of the soy bean alone. In northeastern North Carolina soy beans have practically replaced cowpeas, and the soy bean is now the only legume largely used for soil-improvement purposes in that section.

A second use of soy beans is as feed for live stock. Soy-bean hay is a valuable forage, excelling cowpea hay. Cattle and horses like it

NOTE.—Sincere thanks are expressed for aid received in preparing this bulletin to the farmers from whom most of the material was obtained; to Mr. C. E. Hope, who assisted in making an economic survey in the soy-bean area of North Carolina; to experiment-station workers, county agents, and specialists of the Office of Forage-Crop Investigations, with whom many of the conclusions were discussed; and to the cotton-oil companies, which have manifested a helpful interest.

better and it is more nutritious. The soy-bean hulls, stems, and leaves left from thrashing are used for feeding livestock, and some farmers feed nothing else to the work stock for roughage the year around. Waste beans left from harvesting, and soy beans planted in corn, are pastured by hogs with profit, and the forage left on the land is pastured by cattle and horses. A field of soy beans is sometimes hogged down without any other harvesting; but this is not a common practice, for the crop can generally be used more profitably in other ways. Soy beans make a soft pork, much like the peanut-fed product. The pork may be hardened by adding corn to the ration while pasturing or by feeding on corn alone after taking the hogs off of the soy beans.

Lastly, the bean itself is an important commercial product. The beans are sold for seed, for canning, and for using in other ways for human food, and for oil and meal. At present the demand for seed takes a large proportion of the beans produced. Canning companies use the beans for mixing with navy beans. Considerable quantities of beans are retailed to consumers, who use them much like navy beans. Of recent years cotton-oil mills have been using the beans for expressing oil and producing meal. The machinery that is used for crushing cotton seed can be used for crushing soy beans, and as the average cotton-oil mill is in operation only about half the year these mills can be used without added cost of equipment for handling soy beans. A ton of soy beans, $33\frac{1}{2}$ bushels, will yield approximately 240 pounds of oil and 1,620 pounds of meal, the amount depending upon the character of the beans and the efficiency of the manufacturing operations. The remaining 140 pounds is invisible waste, mostly moisture driven off in the process of manufacturing. It costs practically the same to work soy beans in this way as it does to work cotton seed. If the mills were especially designed for crushing soy beans, it would probably cost less, for it is not necessary to delint and hull soy bean seed, as is done with cotton seed to extract the oil and produce the meal. The oil sells for about the same prices as cotton oil and is used in many similar ways. The meal sells for nearly a third more than cottonseed meal, for it contains a higher percentage of protein. It is valuable both for feed and for fertilizer, and ground soy bean cake made from clean saved beans has many possibilities as a food stuff, as it can be used in a variety of ways in cooking. The outlet for soy beans for crushing is therefore practically unlimited and the market for beans is assured.

Soy beans bring the highest prices for seed, somewhat less for canning and other food purposes, and least for crushing. For this reason, with the limited supply of American-grown beans that now go on the market, it is only after the other demands are supplied that the mills are able to buy. Nevertheless, cotton-oil mills are

active in helping farmers to grow soy beans, with the idea that in the future the production will be so increased that large quantities will be left for crushing purposes. These mills are already using large imports of soy beans grown in Manchuria and would use the American beans if they could be obtained.

AREA AND SOILS ADAPTED TO SOY BEANS.

The area in the western part of the cotton belt that is well adapted to soy beans is limited to some extent by scant or irregular rainfall. In most of Texas, except in the eastern and northeastern parts, the rainfall is either insufficient or too uncertain for the crop to be profitable for seed year in and year out. In some years soy beans make a fair growth of forage, but only a small amount of seed. Oklahoma is like Texas, and the crop does well only in the more favored por-



FIG. 1.—A field of soy beans in southeastern Oklahoma, grown for seed.

tions. (See fig. 1.) Outside of these two States the rainfall is suitable for growing soy beans throughout the cotton belt.

The soils best adapted to soy beans are the stiffer grades, although with good tillage, good crops may be grown on sandy loam types. In northeastern North Carolina the soil on which the best yields are made consists of a stiff top soil (which, however, contains some very fine sand) and a rather impervious subsoil. The land is drained by open ditches comparatively close together, and the water is frequently drained into the ditches by means of open furrows. There are other types of soil in this section, including some sandy loam, but farmers commonly say that the stiff soils are best for soy beans. On the sandy soils, even though the plant may grow as large, it usually does not fruit as well. The areas in the cotton belt that seem to be especially well adapted to soy beans are the black lands of Alabama

and Mississippi and the Delta region of the Mississippi. Some farmers are already making a success of the crop in these areas. The piedmont section should grow beans successfully, and scattered plantings have proved profitable in this region. The stiffer soils in the coastal plain section of the South should also produce good crops of soy beans. In fact, outside of the sandy soils or some of the sandy-loam soils containing a high percentage of sand, most of the cotton belt that has sufficient rainfall is well adapted to soy beans.

BEARING ON OTHER LEGUME CROPS.

Other legumes that are extensively grown in the cotton belt are peanuts, cowpeas, and velvet beans. The peanut is not a serious competitor of soy beans, since peanuts grow best on the sandy and sandy-loam types of soil. In North Carolina where there is a peanut district adjoining the soy-bean district, the peanuts are produced almost exclusively on sandy-loam soils and the soy beans on stiffer soils. Although the two districts are much alike except in the matter of soils, the two crops are practically noncompetitive because of the soil requirements of each crop. On some farms both soy beans and peanuts are grown, but farmers make a practice of planting the soy beans on the stiffest lands and the peanuts on those that contain the most sand.

Cowpeas, like peanuts, thrive best on sandy or sandy-loam types of soil, and therefore there should be little competition between soy beans and cowpeas on the stiff soils where soy beans do best. Soy beans replaced cowpeas in northeastern North Carolina for three reasons; the better adaptability of the soil for growing soy beans, the frequent failure of cowpeas to produce seed, and the greater ease with which soy beans can be harvested. Soy beans are a more certain seed crop than cowpeas, so no difficulty has been experienced in obtaining planting seed in the soy-bean district, and, as will be explained later, soy-bean seed are harvested with mechanical pickers, while cowpeas must be picked by hand and thrashed or cut and thrashed. For these reasons, except on the more sandy phases of soil, soy beans, when handled intelligently, are usually a better crop than cowpeas.

Velvet beans do well on both sandy and stiff soils. Their special use is for planting in corn, and for this purpose they compete with soy beans. They do not, however, always mature seed in the northern limits of the cotton belt, while soy beans can be grown in much colder climates than can cotton. Where no other crop is planted, soy beans are preferable on stiff soils, for the yields of seed are as high or higher than velvet beans, and the crop is more easily harvested. On sandy soils, however, the velvet beans should make the better yield.

As a money crop, the soy bean has an advantage in a wider market, which makes the crop easier to sell. Furthermore, soy beans at present command a much higher price than do velvet beans. There is a large place for both crops in southern agriculture, and on many farms both should be included in the same system.

COMBINING SOY BEANS WITH OTHER CROPS.

Soy beans have a long planting period, beginning with corn planting and lasting in the South until the early part of July. Regardless of the time they are planted within this period, there is rarely more than a week or ten days difference in the date of maturity. This permits the crops to be used in various combinations, which may be determined by soil, climatic, and economic conditions. Briefly stated, the different ways in which soy beans are planted in the soy-bean district of northeastern North Carolina, or in other parts of the South, are as follows:

1. As a first crop for seed, occupying the land for a whole season, with the beans planted in rows usually after the cotton is planted.
2. As a first crop for hay, sown broadcast, at about the same date as the first crop for seed is planted.
3. In the row with corn.
4. In alternate rows with corn.
5. As a second crop for seed planted after small grain or Irish potatoes.
6. As a second crop for hay, planted after small grain or Irish potatoes.
7. Sown broadcast or drilled in corn at the last working.
8. Drilled in alternate rows of cotton at the last working.

Throughout the cotton belt wherever soy beans can be successfully grown, one or more of these ways can be used.

AS FIRST CROP FOR SEED.

The most common method of planting soy beans is as a first crop for seed. In this way, on medium or stiff soils which may be difficult to prepare for a second crop after small grain, soy beans can be grown to good advantage in cropping systems that include cotton, corn, and velvet beans. By planting from one-fifth to one-third of the crop land in soy beans and with either soy beans or velvet beans planted in the corn, a profitable combination of crops can be developed. In this combination, which, except for the use of velvet beans in corn, is practiced quite extensively in Hyde County, N. C., the stems, leaves, and hulls left from the soy beans when cut and thrashed furnish rough feed for the live stock. Where a picker is used, most of the roughage is left on the land. Furthermore, where the land is fertilized, as it is over a large portion of the cotton belt, the soil fertility can be maintained or increased by this system. The labor required in growing a first crop of soy beans does not conflict seriously with work on other crops, except perhaps during the period

of cultivation. The planting is done after the cotton is planted, so there is not much conflict at that time. The soy beans can be cultivated with a two-horse cultivator, which can be used on cotton and corn, at least during a part of the season.

Growing soy beans in connection with cotton and corn in this way tends to promote the use of two-horse implements, for, as the labor required for harvesting soy beans is less than for cotton, a large acreage of crops can be grown per man. Where soy beans are grown extensively it is not uncommon for farmers to use two-horse implements and grow as much as 40 acres of crops per man, the acreage being divided about equally between cotton, corn, and soy beans. The time for harvesting mammoth yellow soy beans in northeastern North Carolina is the last of October or the early part of November, and while this time conflicts with that of harvesting cotton and corn, soy-bean harvesting requires such little labor, and the other crops, particularly corn, can so often be left a little time without deteriorating, that farmers usually do not encounter serious difficulty in getting the work done. Even if only a small part of the crop land is planted in soy beans for seed as a first crop, the man-labor and horse or mule labor is better utilized than when soy beans are omitted, and the farm is usually made more profitable, especially when the soil improvement is considered.

AS FIRST CROP FOR HAY.

Soy beans are often planted for hay as a first crop where it is felt that the land is too poor to make it profitable to cultivate the beans for a seed crop. In this way they are used very much as cowpeas are often used on poor land, planted primarily for the soil improvement, but, if the growth happens to be large enough, also to be cut for hay. The work in this case fits in very well with that on other crops. The beans are sown broadcast, or drilled in after the cotton is planted, and there is nothing more to do until the hay is harvested. With mammoth yellow beans, this is usually about the last of August, when there is ordinarily little or no work to be done on cotton or corn. In some sections this work may conflict with fodder pulling, but it is noticeable that in the soy-bean district only a small part of the fodder is pulled; on most farms it is all left on stalks. On a few farms the soy beans are sown early for hay, cut in July, and followed by a crop of late potatoes.

IN THE ROW WITH CORN.

Soy beans can be used to good advantage for planting in the row with corn. Some farmers plant between the hills of corn at the time the corn is planted, but many object to this method on the ground that the beans start up more quickly than corn and check the growth

of corn, thereby decreasing the yield of the latter. If, however, the beans are planted in the row when the corn is about six inches high, the yield of corn is not affected; and any growth of beans, except for the cost of planting, is clear gain.

Drilling soy beans in the row when the corn is planted is not extensively practiced, but where corn is grown for ensilage, and both the corn and beans are put in the silo, there is an increase in the total yield of ensilage, even though there may be a small decrease in the yield of corn. It would seem that this method of planting soy beans should have a wider use.

Soy beans planted in the rows of corn can be used for pasturing with hogs or cattle after the corn is husked out. Some farmers, however, harvest the beans for seed, either by pulling the beans or



FIG. 2.—Soy beans planted in alternate rows with corn. The beans are ready to harvest.

cutting them with a sickle, after which they are thrashed or flailed out; or the stalks of corn are cut out and the beans harvested with a picker.

WITH CORN IN ALTERNATE ROWS.

The method of planting corn and soy beans in alternate rows (see fig. 2) is followed on several farms with good results. The practice is increasing, particularly in areas with sandy loam soils where soy beans have been grown for only a few years. Farmers around Hertford, N. C., who are planting soy beans and corn in this way get considerably more than a half crop of corn and a half crop of soy beans, some even as much as three-fourths of a crop of each. The corn is planted thicker in the row than ordinarily, as it has more air space and sunlight than when planted as usual, and also more root space, since the roots of the soy beans do not spread as far as the corn roots. The corn is planted early, and the beans are planted when the

corn is from 1 to 2 feet high. Both are cultivated just alike—usually with a two-horse cultivator. The rows are generally from 3 to 3½ feet wide, but sometimes they are placed closer together, in which case the cultivating is done with one-horse implements. On some farms the beans are grown successfully between corn rows when the corn rows are only 5 feet apart. Some farmers who have a medium soil and who grow cotton, corn, soy beans, and peanuts, plant about one-third cotton, one-third corn, with soy beans in alternate rows, and one-third peanuts. In harvesting, the beans are picked with a picker and the corn husked later. This system is open to the objection that if the corn should blow down there may be some difficulty in harvesting the beans.

SOY BEANS AFTER SMALL GRAIN OR IRISH POTATOES.

In Hyde County, N. C., on a loamy soil of medium texture, soy beans are found to be very profitable when planted after small grain as a second crop. The beans are planted either for hay or seed, but they are usually most profitable when grown for seed. It is often hard to get the grain crop harvested and the soy beans planted in the short time available, and at the same time to cultivate the cotton crop, but it is no more difficult than harvesting grain and planting cowpeas, which is done on many of the better farms throughout the South. The time for harvesting for seed and for hay is usually a week or 10 days later than the harvesting period of the first crop.

Soy beans are an excellent crop to plant after early Irish potatoes. The potatoes come off some time before the time for harvesting small grain, and the land is usually left in such condition that it can easily be prepared for soy beans.

A good yield from soy beans as a second crop can not be expected if the fertility of the land is low. If the land is poor the beans should be planted as a first crop.

The texture of the soil and the amount of rainfall largely determine the feasibility of growing soy beans as a second crop. Soils that bake and become hard in dry weather often can not be prepared for a second crop in the middle of the summer. Soy beans, for a second crop, are therefore an uncertain proposition for such soils. The same trouble is experienced with cowpeas in several parts of the South, particularly the Piedmont. On medium soils, such as the Portsmouth sandy loam and the Orangeburg sandy loam, this difficulty is not often experienced, and soy beans should do well on these soils when planted after small grain or early Irish potatoes.

If the second crop is to do well there must be a sufficient supply of rain during July and August. Sections that have a limited rainfall during these months can not grow a good yield of soy beans as a second crop, and they are not the best areas even for them as a first crop.

IN CORN AT LAST WORKING.

One of the more profitable ways of planting soy beans is in corn at the last working. The seed may be either sown broadcast or drilled. The plants grow from 12 to 24 inches high, and if harvested these often yield from 4 to 10 bushels of seed per acre. Farmers in the soy bean district stated that this growth of soy beans in corn was worth from \$5 to \$10 per acre for pasture for hogs and cattle after the corn was husked, to say nothing of the soil improvement. Sometimes a farmer will cut the beans with a sickle and thrash them out for seed.

IN ALTERNATE MIDDLES IN COTTON.

Rows of soy beans can be planted in alternate middles in cotton, as cowpeas are often planted in the South Atlantic States. Every other middle is left vacant to give the cotton pickers a place to work. The beans can either be turned under for soil improvement, grazed, or harvested like soy beans planted in corn at the last working.

VARIETIES OF SOY BEANS AND SEED REQUIRED PER ACRE.

Taking the cotton belt as a whole, the mammoth yellow¹ is the best variety of soy bean to plant. No other variety even approaches it in acreage planted, and, for all conditions, no other has proved a better yielder. The experiment stations are testing numerous varieties, and a better variety eventually may be found; but for the present farmers in the cotton belt can do no better than to plant the mammoth yellow, although for special conditions, such as early beans for hogs, other varieties may be more satisfactory. The mammoth yellow is suitable for both seed and hay, and is well known in commercial channels. It is a yellow bean and a variety that is suitable for human food. Cotton-oil mills like it on account of its oil content and its color, for it makes a yellow meal which is acceptable to farmers who are accustomed to cottonseed meal, and who look upon a dark-colored meal as one that is damaged. The mammoth yellow soy bean grows erect and stands up well, so that it can be harvested with a mechanical picker, which is not the case with several other varieties. At least 90 per cent of the soy beans grown in the cotton belt are of the mammoth yellow variety.

In northeastern North Carolina there is a brown soy bean that is preferred for forage, and frequently yields more seed than the mammoth yellow, but as it sells for a much lower price on the market it is not grown except for home use.

Old soy bean seed should not be planted, since but very little of it will germinate. In the soy bean section of North Carolina an average

¹ Outside of the cotton belt other varieties of soy beans do as well or better than the mammoth yellow. Generally speaking, the mammoth yellow should not be grown for seed more than 100 miles north of the cotton belt. North of the Ohio River it does not always mature seed.

of three-fourths of a bushel of seed is used per acre when planted for seed and two bushels per acre when planted for hay. To keep the plants from growing too large and from branching too much, heavier seedlings are made on the best lands. It is generally considered that the plants should be from two to three inches apart in the row. In planting in the corn row, from one-fifth to one-half bushel per acre is sufficient. In planting in corn at the last working an average of one bushel per acre is used.

FARM PRACTICE IN GROWING SOY BEANS.

INOCULATION.

In most of the cotton belt nodule-forming bacteria for soy beans, which make the free nitrogen of the air available, are already in the soil, but usually in limited quantities, and for the sake of safety inoculation frequently is advisable. This inoculation can be made in several ways. One is by transferring soil to the new field from a field where soy beans have been successfully grown and nodules have formed on the roots of the plants. Care should be taken to keep the inoculating soil out of the sunlight from the time it is taken out of the old field until it is worked into the new. A cloudy day or a time early in the morning or late in the evening should be chosen for making the transfer. Two hundred pounds or more of soil should be used per acre and should be harrowed into the soil immediately after scattering. Another method is to inoculate the seed with artificial cultures. In some States these cultures can be obtained from State agencies at a nominal cost. Directions for using the cultures accompany each package. Still another way is to moisten the seed with a thin solution of molasses and water and then thoroughly mix fine dry dirt from an old soy bean field with the seed. After the seed is dry it can be planted in the usual way.

Nitrogen-bearing fertilizers have the same effect on the growth of the soy bean as do the nodule-forming bacteria, and often when planting them for the first time farmers fertilize with 200 pounds of cotton-seed meal per acre to insure a crop while the nodule-forming bacteria are developing in the soil.

Some nodule-forming bacteria are usually carried with seed that is not artificially inoculated, owing to the fact that in the process of harvesting and thrashing the seed become more or less coated with soil dust, and farmers say that where soy beans are planted without either inoculating or fertilizing with cottonseed meal, the yields increase from year to year, until three crops of beans have been grown on the land. This is evidently due both to the improvement in the inoculation and to the increase in fertility of the soil, but largely to the inoculation. The bacteria carried with the seed or the limited number already in the soil multiply from year to year until the supply is sufficient.

DISTANCE BETWEEN ROWS.

The distance between rows in planting soy beans is about the same as for cotton, commonly from $3\frac{1}{2}$ to 4 feet. Closer planting, however, gives better yields, and some farmers make the rows 2 feet apart. The implements used in cultivating determine to some extent the distance between rows. Where the cultivating is done with one-horse implements ordinarily the distance should not be more than 30 inches, but where an ordinary two-horse corn cultivator is used the rows should be 3 feet or more apart. This, however, may cause a sacrifice in yields for the sake of ease in cultivating. The rows must be 3 feet or more apart if a picker as now made is to be used in harvesting. Most soy beans grown for seed are planted in rows 3 feet or more apart.

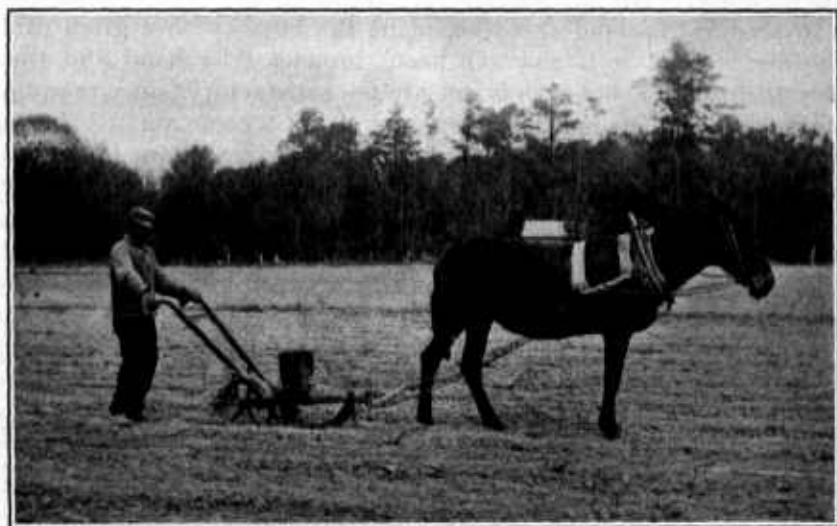


FIG. 3.—Planting soy beans with a cotton planter.

PLANTING AND CULTIVATING.

Where soy beans are grown for seed as a first crop—that is, where they occupy the land for a whole season—they are planted very much like cotton. They are rarely planted below the level of the land, but rather on the level or on a slight ridge. Except as regards fertilizing, there is no serious mistake in planting soy beans like cotton, and this method is commonly followed when the soy beans are grown as a first crop. They are planted with either a corn planter or a cotton planter (see fig. 3) with plates. The soy beans on most farms where they are grown for seed in the soy-bean district (see illustration on title page) are commonly cultivated with two-horse cultivators. They are cultivated from two to four times. There is but little hoe work. The plants start off quickly, and it is possible

to plow close to them and throw the earth into the row and kill weeds before they get a good start. Many farmers never use a hoe in cultivating soy beans. In planting after oats or wheat the rows are usually closer together, commonly 2 feet apart, so a different method is used. In this case the beans are planted practically on the level and cultivated with one-horse implements.

Another method of planting, but not practiced in the cotton belt, although in some places it could be used, is to plant the beans on well-prepared land with a grain drill (see fig. 4) closing up some of the feed holes so the rows will be from 24 to 30 inches apart. Four rows are planted at a time in this way, and the cultivating is done with a four-row sugar-beet cultivator. This method is particularly advisable where the land is level and not too weedy.

Soy beans for hay are planted just like cowpeas. The best method is to prepare the land and then plant the beans with a grain drill. Another method is to sow the beans broadcast by hand and then plow them under, but this is not always satisfactory, since many of the beans are covered too deep and do not come up. A better method than this is to break the land, sow the soy beans broadcast, and then harrow them in with a disk harrow or a smoothing harrow.

Where soy beans are planted in corn at the last working, the beans are sown broadcast by hand and are covered as the corn is cultivated.

In planting soy beans in the corn row between hills the beans may be planted when the corn is planted or, better, when the corn is about 6 inches high. When planted at the same time, the corn and beans are both planted with the same planter, there being two hoppers,



FIG. 4.—Field of soy beans at Danville, Ky., planted with a grain drill and cultivated with a sugar-beet cultivator, 4 rows at a time. This method might be used to advantage in the cotton belt.

one containing corn and the other soy beans, the corn and beans being dropped alternately. When planted after the corn is up, the beans are planted with a hand planter or with a hoe. Where the beans are drilled in the row with corn, the beans and corn may be mixed together and planted with one hopper, or two hoppers may be used and the beans and corn drilled from separate hoppers. In any case the soy beans should be planted not over 2 inches deep.

FERTILIZERS USED.

Like cowpeas, soy beans are not heavily fertilized, if at all, farmers usually depending upon the residual effect of the fertilizers applied to other crops. Lime, applied as ground limestone, ground oyster shell, or burned lime usually increases the growth of soy beans (except in limestone areas), but it is not always needed to produce a profitable crop. In actual practice most of the farmers in the soy-bean district of North Carolina use some form of lime, since most of the soil there is acid. The lime is secured quite easily, and the increased yields considerably more than pay the cost. The lime is applied at the rate of 2 tons of ground limestone per acre once in four or five years, or it is scattered on top of the row at the rate of about 1,000 pounds per acre just before the soy beans are planted. Light applications, occasionally as low as 150 pounds per acre, are frequently drilled in a furrow and covered, the beans being planted above.

Sometimes acid phosphate is used. This is applied generally at the rate of 200 pounds per acre and is drilled in the row before the beans are planted. On soils deficient in potash kainit is sometimes used, but the most common practice with both acid phosphate and kainit is to fertilize the preceding crops and depend upon the residues for the soy beans. Cotton-seed meal, as previously stated, is sometimes used when planting soy beans for the first time, and sometimes on other plantings where the soil is sandy or sandy loam. The common application is from 100 to 200 pounds per acre, drilled in the row before planting the beans.

HARVESTING.

The difficulty farmers have experienced in harvesting has been the greatest handicap in the extension of the production of soy beans.



FIG. 5.—Hollow rack used for curing soy bean hay.

The development of new machines and accumulated experience with the crop, however, have overcome most of the troubles, so that farmers in the soy-bean district consider it little, if any more, trouble



FIG. 6.—Soy bean hay stacked on hollow racks.

to harvest soy beans, except for hay, than it is to harvest oats or wheat.

Harvesting soy beans for hay is practically the same process as harvesting cowpeas for hay. Any difference is in favor of the soy beans, for the vines grow more erect and do not become tangled like cowpeas. Soy-bean hay is usually made by cutting when the pods are half filled and partially curing in the swath before raking. Sometimes a tedder is used for curing, but not often. After the soy beans are raked into a windrow they may be hauled directly to the stack or barn, but the usual custom is to shock them on hollow racks made of poles as shown in figure 5. When the soy beans are shocked on these racks (see fig. 6), there is a hollow space on the inside which allows a passage of the air and causes more rapid and thorough curing. The hay is so thoroughly cured on these racks that it can be baled out of the shock (see fig. 7), which frequently is done. The usual custom, however, is to store the hay loose in the barns.

In harvesting soy beans for seed mechanical pickers (see fig. 8) are used quite extensively. These pickers are of different makes, but all have the same general principle. They run astride the rows and knock out the beans, leaving the stems, leaves, and hulls on the land. The machine is drawn by two mules and operated by two men. One man drives and another throws out the excess trash that accumulates in the back of the machine. The picker will hold from 4 to 6 bushels of beans. When it is full, the beans are emptied

and handled in different ways. In one common method the beans are run through a half-inch mesh sieve to remove the coarse trash and then are sacked. One or two men handle the sieve. These men may be the same who operated the machine or they may be extra men. After this the beans are cleaned with a fanning mill.

Harvesting with a picker begins some time after the leaves of the plant have fallen (see fig. 9). The time to begin is when the first pods pop open and throw out the beans. As the picker works best only when the beans are dry, the machine is not started in the morning until the dew is off, which is usually from 9 to 11 o'clock. When the day's work is once started, it is customary to continue work until nightfall without stopping for dinner. In the soy-bean district picking usually begins about the last of October and lasts through approximately 10 days of good picking weather. If it rains, the maturing of the beans is checked and picking is resumed when the weather again becomes dry. A machine will pick from 3 to 6 acres per day, averaging about $4\frac{1}{2}$ acres. In a season a machine will pick from 30 to 50 acres, but it is rarely safe to attempt to harvest more than 40 acres with one machine, since if left until the end of the season too many of the beans pop out before they can be harvested.

The waste of beans in picking usually varies from one-twentieth to one-fourth, and, as a rule, averages about one-eighth. If the plants are blown down or have long branches so the machine can not handle them well, the waste may be more than this, or if the beans are left on the

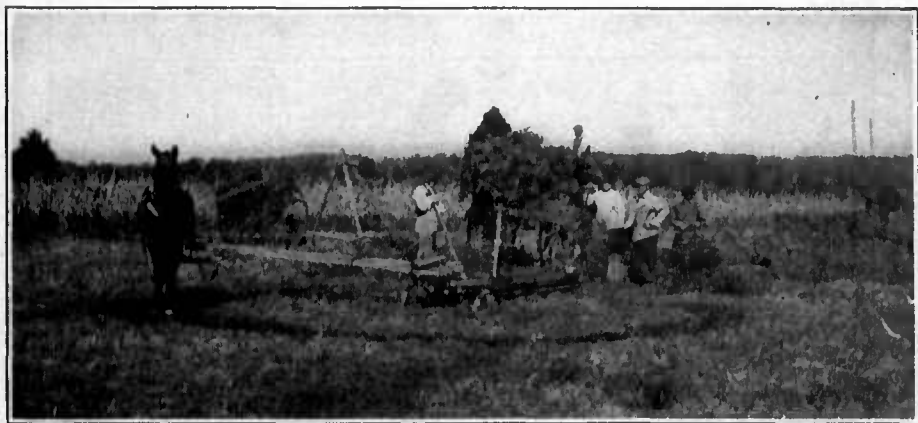


FIG. 7.—Baling soy bean hay in the field from hollow racks.

vines too lato, so that many of them pop out, the wastage may be higher. Varieties of beans that begin fruiting some distance from the ground can be harvested with the least waste by a picker, and this is

one advantage of the mammoth yellow soy bean. Hogs are usually turned in to clean up the waste beans, so that in fact there is very little loss.

A picker costs about \$125, and so is within the reach of many farmers. A farmer with a small acreage of soy beans frequently buys a picker and, in addition to his own work, does custom work for his neighbors. In this way his machine is profitably used. The common price for picking beans with a picker is 20 cents per bushel, or a toll of one-tenth of the beans. In northeastern North Carolina approximately four-fifths of the beans grown for seed are harvested with pickers. Altogether there are now in use over 1,500 pickers, some of which have been in use for 10 years and have picked over 8,000 bushels of beans. It is noteworthy that the pickers are replacing other methods of harvesting and that the increase in the acreage of soy beans in the cotton belt can be attributed largely to these machines.

Another way of harvesting the soy beans is to cut them with a binder and thrash them out with a grain thrasher (see fig. 10) adjusted for handling beans. This method has an advantage in some cases, in that the stems, leaves, and hulls may be saved for forage if so desired, whereas with the picker most of these are returned to the soil, although a part of them may be eaten by cattle and horses turned in after harvesting. This, however, is frequently an advantage on the side of the picker, for the farmers often prefer to have



FIG. 8.—Emptying a soy-bean picker and screening the beans.

their material returned to the land for soil improvement. The soy beans, when harvested with a binder, are cut earlier than when harvested with a picker, since to save the seed they must be cut before the pods start bursting open. After the beans are cut they are shocked like oats or wheat and left standing until thrashed. Soy beans after shocking are not damaged seriously by bad weather, and are often allowed to stand in the field for a month. There is some waste in harvesting when the beans are cut with a binder, but it rarely exceeds one-twentieth of the crop. The price paid for thrashing beans is usually a toll of one-eighth. In thrashing soy beans the grain thrasher is adjusted so that the cylinder runs more slowly than when thrashing grain, while the rest of the machine runs at the usual speed. This is arranged by using larger pulleys on both ends of the cylinder shaft. Also a part of the cylinder and concave teeth are removed. With these changes not many beans are cracked.

The old-fashioned self-rake reaper is also used in harvesting soy beans, leaving the bean vines on the ground in loose bundles. Three rows of these bundles (see fig. 11) are sometimes thrown into one by a man with a fork. Whether the beans are piled in this way or left to lie as they are dropped from the reaper, they are allowed to cure for three or four days before thrashing. The reaper is used in a section where oats are little grown and where ordinarily a binder is not needed. In point of cost of the machine the reaper is more economical than a binder, since it costs only about half as much. The quality of the beans harvested with a picker is usually regarded as higher than that of beans harvested with a binder or reaper and thrashed.



FIG. 9.—Field of mammoth yellow soy beans ready to harvest for seed.

There is less damage from bad weather, and the beans are not cracked. A dealer in purchasing beans without seeing the sample would prefer beans harvested with a picker.

YIELDS.

The yield of soy beans is dependent upon soil and seasonal and cultural conditions; hence, as may be expected, there is considerable variation. On 50 farms studied in northeastern North Carolina the lowest yield in 1916 was 4 bushels and the highest 39, averaging 18.9 bushels exclusive of the waste beans. Occasionally a farmer harvests over 40 bushels per acre, but this is not usual. Perhaps the yield that may be expected can best be indicated by comparing the yield of soy beans with that of corn. On the farms studied the yield of corn averaged 29.7 bushels, or the yield of beans was a little over 60 per cent of the yield of corn. As a general proposition it may be stated that in the cotton belt on soils adapted to soy beans the yield in bushels will approximate three-fifths that of corn.¹

In addition to the beans there are the stems, leaves, and hulls left from thrashing or picking. The weight of these when dried will vary with the fruiting of the plants and the variety of the beans, but on an average, where the beans are thrashed, it will, in the case of the mammoth yellow beans, just about equal the weight of the beans.

Soy beans are planted thicker for hay than for seed, so in this case the weight of the forage per acre is heavier than when the beans are

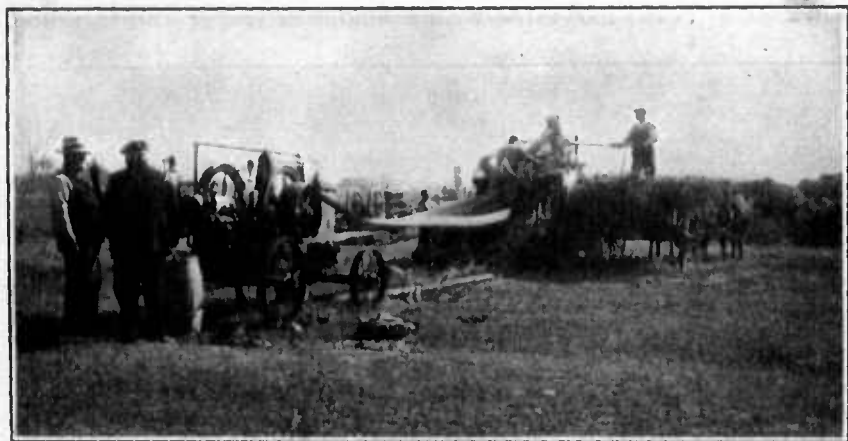


FIG. 10.—Thrashing soy beans.

planted for seed. The hay commonly yields from one to two tons per acre. Land that will produce 30 bushels of corn in the cotton belt should yield around two tons of soy-bean hay per acre.

¹ A bushel of soy beans weighs 60 pounds and a bushel of shelled corn 56 pounds.

COMPARATIVE LABOR REQUIREMENTS.

The amount of labor required in growing soy beans for seed is on the whole about the same as that required for growing corn. Compared with cotton the labor requirement of a crop of soy beans is



FIG. 11.—Soy beans cut with a self-rake reaper and piled in small bunches for curing preparatory to thrashing.

much less. With crops of 1,200 pounds of seed cotton and 20 bushels of soy beans per acre, the man labor in growing soy beans is one-third and the mule labor, including harvesting, three-fourths that of cotton. On an average farmers do about one-eighth as much hoe-work for soy beans as for cotton, but most farmers do not hoe the beans at all.

As a general proposition the cost of producing an acre of soy beans for seed is the same as the cost of an acre of corn. The costs will run so close together that one can safely figure on this basis. The cost of producing an acre of soy beans for hay is practically the same as the cost of an acre of cowpea hay. It costs approximately twice as much to grow an acre of cotton as it does to grow an acre of soy beans.

SELLING PRICES OF SOY BEANS AND SOY-BEAN FORAGE.

The price of soy beans within the last few years has been subject to wide fluctuations. In some years, before soy beans were used for food purposes, and before the oil mills bought them, they sold as low as 60 cents per bushel. In normal times the selling price has been around \$1 per bushel. In 1916, however, most of the crop in the soy-bean district was marketed for about \$2 per bushel, and in the spring of 1917 considerable quantities of beans were sold for seed purposes at \$5 per bushel. In the fall of 1917 beans were commonly quoted at \$2.50 per bushel in the local market. In selling beans it is

usual for the purchaser to furnish the sacks. This practice probably will develop throughout the cotton belt.

Soy-bean hay sells for about the same price per ton as alfalfa hay. The stems, leaves, and hulls left from thrashing sell locally for about three-fifths as much, but there is no other market for them.

DIVISION OF CROP WITH CROPPERS AND TENANTS.

Landowners who rent land to croppers or tenants usually charge the same rent for land planted in soy beans as for land planted in corn. This is usually one-half of the crop for croppers and one-third for tenants.¹ If the beans are thrashed, each party pays for his share of the thrashing, and the party owning the work stock gets the stems, leaves, and hulls left after thrashing. If a picker is used, the landowner usually furnishes it and charges the cropper or tenant for picking his part of the beans. Now and then the picker is owned in partnership. Sometimes the landowner furnishes rent free land low in fertility in order to get the soil improvement.

If the land is rented for cash, the same charge is made when it is planted in soy beans as when planted in corn.

¹ Croppers furnish only their labor and a share of the fertilizer, while tenants furnish labor, teams, implements, and a share of the fertilizer. Both classes furnish fertilizer in proportion to the share of the crop they receive.

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